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**WABAMUN AND AREA
COMMUNITY EXPOSURE
AND HEALTH EFFECTS
ASSESSMENT PROGRAM
(WACEHEAP)**



SUMMARY REPORT
AUGUST 2006

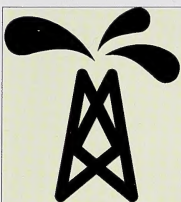
The leadership of the Wabamun and Area Community Exposure and Health Effects Assessment Program (WACEHEAP) was directed by a variety of community partners including government, industry and community associations. The membership was composed of:

- ◆ Alberta Environment
- ◆ Alberta Health & Wellness
- ◆ Capital Health
- ◆ EPCOR
- ◆ Health Canada
- ◆ Lake Wabamun Enhancement & Protection
- ◆ Leduc County
- ◆ Mewassin Community Action Council
- ◆ Parkland County
- ◆ Paul First Nation
- ◆ TransAlta

The Science Team and Steering Committee would also like to gratefully acknowledge the contributions made by all volunteers in the Wabamun and surrounding area whose participation in the program was critical to the success of the program.

Disclaimer: The organizations represented on the Steering Committee of WACEHEAP are to be recognized for their contributions and support of the Wabamun and Area Community Exposure and Health Effects Assessment Program. Although the program is directed by a multi-stakeholder consultation process, this scientific report may not reflect the views of the organizations represented on the Steering Committee. Any inquiries regarding the methods utilized in compiling and analyzing information and samples collected from the participants should be directed towards the Public Health Surveillance and Environmental Health Branch, Alberta Health and Wellness.

WHAT IS WACEHEAP?



Some people who live in Wabamun and surrounding area, have concerns about how coal-fired power stations and oil & gas operations affect air quality and impact on human health.



Goals of WACEHEAP:

- ◆ Measure exposure of residents from Wabamun and area to airborne chemicals and particulates;
- Examine the role indoor and outdoor air has on personal exposure to air contaminants; and
- Look at relationships between exposure to airborne chemicals and illness in people within Wabamun and surrounding area.

When was the data collected?

May to
November 2004

How many people participated?

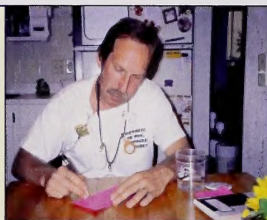
Total: 196 participants

- ◆ 123 residents from urban and rural areas
- ◆ 73 residents of Paul First Nation

HOW WAS THIS DONE?

Volunteers were asked to:

- ☒ Wear personal air monitors to sample the air in their breathing zone for 24 hours per day for 7 consecutive days.
- ☒ Have air monitoring stations set up inside and outside their homes.
- ☒ Give a sample of blood, urine and hair to determine exposure to contaminants.
- ☒ Answer survey questions about their health, diet and other life-style factors.



Where were the participants from?

Devon	Warburg
Spruce Grove	Thorsby
Stony Plain	Parkland County
Wabamun	Leduc County
Paul First Nation	
Calmar	

- A map showing the program area is at end of this report -

ABOUT THE PARTICIPANTS

Two different participant groups were created:

Urban & Rural

Paul First Nation

Paul First Nation is a unique population as they live closest to the large industries in the area. Their length of residency in the area is also longer than most residents (see below). These residents may also be involved in activities on the land, such as hunting or fishing, which could increase their exposure to some contaminants.

In both groups:

- ◆ There was a high number of females
- ◆ Many participants were retired or homemakers
- ◆ A high number of the participants were 40 years of age or older
- ◆ Over 60% of all participants had a body mass index (BMI) of 25 or higher. A BMI of 25 or higher can indicate that an individual is overweight which could lead to health problems.



Length of Residency

- ◆ 50% of urban and rural participants lived in the Wabamun program area for 10 years or more
- ◆ 63% of the Paul First Nation participants lived in the program area for 15 years or more

Rates of Tobacco Use

- ◆ 11% of urban and rural participants were smokers
- ◆ 65% of Paul First Nation participants were smokers

THE CONTAMINANTS

Five different air contaminants were investigated:

Nitrogen Dioxide (NO_2)

Sulfur Dioxide (SO_2)

Ozone (O_3)

14 Volatile Organic Compounds (VOCs)

Particulate matter ($2.5\mu\text{m}$)

These air contaminants were selected because:

- (1) They are of concern to local people in the area;
- (2) There are government efforts to reduce levels in the environment; and
- (3) They can be measured accurately.

Three air samples were taken for each participant:

Personal

Monitors worn by participants all day to see what the level of contaminants was in their breathing zone.

Indoor

Monitors placed inside the participant's home.

Outdoors

Monitors placed outside the participant's home.

NITROGEN DIOXIDE (NO₂)

Nitrogen Dioxide or NO₂ is produced by vehicles, oil and gas operations and power plants. Other sources are natural gas appliances and forest fires.

The table below shows the median level for the Wabamun and area program. Two values are provided for comparison: (1) the 2001 Ft. Saskatchewan and area program results and (2) applicable guideline levels. As these levels are from multiple sources, please consult the WACEHEAP Final Report for more information.

	Personal (median) µg/m³	Indoor (median) µg/m³	Outdoor (median) µg/m³
Wabamun (2004)	8.1	6.8	5.8
Ft. Saskatchewan (2001)	13.7	10.0	10.4
Guideline/Reference Level	N/A	480*	400** 200***

*one hr ** one hr average *** 24 hr average

What influenced personal NO₂ exposure?

- ◆ Indoor air levels (most important factor) which are affected by tobacco smoke and age of the home
- ◆ Time spent outdoors at work

Exposure Sources of NO₂

- ◆ Local sources or nearby sources (most important)
- ◆ Regional and background sources (lesser concern)

SULFUR DIOXIDE (SO₂)

Sulfur Dioxide or SO₂ is formed when we use any oil, gas or coal products which contain sulfur.

It is released into the air by diesel vehicles, gas plants, pulp and paper mills, power plants and boilers.

	Personal (median) µg/m³	Indoor (median) µg/m³	Outdoor (median) µg/m³
Wabamun (2004)	0.8	0.6	2.6
Ft. Saskatchewan (2001)	0.7	0.3	2.3
Guideline/Reference Level	N/A	1000*	450** 150***

*5 min ** one hr average *** 24 hr average

Exposure Sources of SO₂

Local, regional and background levels are of equal importance as sources of SO₂.

What influences personal SO₂ exposure?

- ◆ Indoor levels (most important) which are affected by having a garage attached to the home and age of the home
- ◆ Time spent outdoors at work

OZONE (O₃)

Ozone or O₃ is a naturally occurring gas found high in the atmosphere. It can also be produced indirectly by industries.

Since ozone can be easily broken down by other contaminants, outdoor levels are not good indicators of personal exposure.

	Personal (median) µg/m ³	Indoor (median) µg/m ³	Outdoor (median) µg/m ³
Wabamun (2004)	3.2	1.6	43.9
Ft. Saskatchewan (2001)	6.1	4.0	47.4
Guideline/Reference Level	N/A	240*	160** 125***

*one hour ** one hr average *** 8 hour

What influences personal O₃ exposure?

- ◆ Indoor levels (most important) which are affected by outdoor levels
- ◆ Amount of time spent outdoors
- ◆ Contact with tobacco smoke

Exposure Sources of O₃

- ◆ Background levels such as indoor levels were the most important source
- ◆ No regional or local sources were identified

PARTICULATE MATTER (PM_{2.5})

Particulate matter (PM) is a mixture of particles of varying sizes which float in the air. The size of these particles are measured in microns. A micron (μm) is very small. A single strand of hair is 40 μm in width.

When particles are smaller than 2.5 μm , they can be inhaled into the lungs. This may affect a person's ability to breathe.

Particles of this size are found in tobacco smoke, aerosols, forest fires and exhaust from power plants or oil and gas operations.

	Personal (median) $\mu\text{g}/\text{m}^3$	Indoor (median) $\mu\text{g}/\text{m}^3$	Outdoor (median) $\mu\text{g}/\text{m}^3$
Wabamun (2004)	28.7	10.7	6.5
Ft. Saskatchewan (2001)	15.1	7.0	6.6
Guideline/Reference Level	N/A	100*	30**

* one hour ** 24 hour

What influenced personal PM_{2.5} exposure?

- ◆ Use of tobacco products or secondhand smoke (most important)
- ◆ An attached garage
- ◆ Type of job or work

Exposure Sources of PM_{2.5}

- ◆ Background levels (most important)
- ◆ Nearby or local sources (minor effect)
- ◆ No regional sources were found

VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs) are a variety of chemicals which contain carbon. In total, fourteen (14) VOCs were sampled for in the Wabamun area. Examples are benzene, toluene, nonane, and decane.

They can be released either naturally or as a by-product of industrial activities. They are also often released into the air by products or materials found in the home. Examples include cleaning products, paints, carpets and glues. Tobacco smoke is also a major source of VOCs.

For the 14 VOCs measured in the Wabamun program, important influences of personal exposure were:

The level of the VOC detected inside a participant's home.

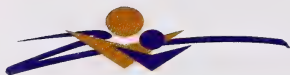
This suggests the existence of indoor sources which affect personal exposure.

Contact with tobacco smoke or second hand smoke

Having a garage attached to the home.

Residents of Paul First Nation may have an increased personal exposure to some VOCs because of personal activities occurring in the home (i.e. smoking, wood fueled furnaces)

These influences were common for all VOCs. For more details about individual VOCs, please see the WACEHEAP Final Report.



BIOMARKERS OF EFFECT & EXPOSURE



Q: What are biomarkers of effect or exposure?

A: They are indicators of the effects of contaminants on the human body.

Q: What biomarkers were used in WACEHEAP?


A: Two groups of biomarkers were examined:

1. Participants provided blood, hair and urine samples. These samples were tested for different chemicals. Blood samples were also tested to see if participants had higher than normal immune or allergy responses.
2. The function of participant's lungs was examined. This was done by spirometry which measured the amount of air entering or leaving the lungs.

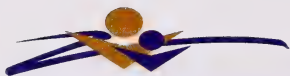
What did we find?

- ◆ Seven chemicals were sampled for in the blood, urine and hair.
 - ◆ Nicotine, mercury, arsenic, benzene and toluene were detected in some participant's samples but none were above normal levels.
 - ◆ Xylene and ethylbenzene were not detected in any of the participant's samples.
- ◆ **Lung function** can be affected after prolonged exposure to air contaminants.
 - ◆ Over 90% of participants had lung function within the normal range of 80-120% or higher.

BIOMARKERS OF EFFECT & EXPOSURE

- ◆ **Immunoglobulin gamma E (IgE)** is an antibody found in the blood which measures allergy response.
 - ◆ 88.5% of participants had intermediate or low levels of IgE
 - ◆ Overall, IgE levels were related to cigarette smoking, having a history of asthma or other respiratory symptoms.
- ◆ **Autoantibodies** are found in the blood and can cause damage to healthy tissues in our bodies. They can predict the development of diseases such as lupus, rheumatoid arthritis or similar conditions.
 - ◆ 34% of participants were weakly positive for autoantibodies. Being positive for an autoantibody does not mean an individual will develop any illness.
 - ◆ These results may have been influenced by the high number of females and participants over the age of 40 who participated in the Wabamun program. Research has shown that females and people over 40 have higher levels of autoantibodies
 - ◆ Many participants also reported having a cold or flu when the blood sample was taken. Illness can cause a temporary increase in autoantibody levels.
 - ◆ Exposure to air contaminants (i.e. benzene, mercury) was not higher for participants with positive results.
 - ◆ A separate health record analysis revealed no increased rate of autoimmune diseases in the WACEHEAP area.

Participants with disease specific autoantibodies will be notified of their results and advised to consult their family physician for further information.



HEALTH RECORDS ANALYSIS

A health record analysis is a way of determining if one community has a higher rate of illness compared to another one.



If the health of residents in the program area is being affected by air contaminants, the rates of asthma, bronchitis, and/or chronic obstructive pulmonary disorder (COPD) may be higher.

The Health Record Analysis Found:

- ◆ Deaths from asthma, bronchitis or COPD were not higher in the program area compared to other communities.
- ◆ There was no increased risk of death from all causes, including respiratory disorders and heart disease.
- ◆ There was an increased rate of visits to the doctor for all respiratory disorders combined. This includes colds, flus, bronchitis, or other similar illness.
- ◆ Although, the number of doctor visits for all respiratory disorders was high, visits specifically for asthma and COPD were lower when compared to other communities who have completed this program.

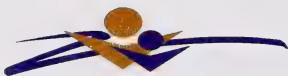
SUMMARY & RECOMMENDATIONS

— Summary —

- ◆ Personal exposure to the selected air contaminants is low in the Wabamun program area.
- ◆ Personal exposure to air contaminants is very related to indoor air quality.
- ◆ No biological or neurocognitive effects directly linked to exposure from air contaminants was discovered in the Wabamun program area sample.
- ◆ There was an increased rate of visits to a physician for all respiratory illnesses, however not for health conditions such as asthma or COPD.

— Recommendations —

1. Establish ongoing monitoring of personal exposure levels to air contaminants.
2. Inform the general public about airborne contaminants and how to manage or reduce their exposure.
3. Participate in the implementation of an organized approach to community exposure and health effects assessment in the province in support of long-term comparisons with other areas across the province.
4. Adopt and promote the use of innovative methods and technologies such as personal exposure monitoring to further our understanding of the relationship between air quality and human health.



Children's Biomarkers of Exposure

The children's component was a pilot project added to the Wabamun and area program. As children are still developing, they may have higher rates of exposure and greater contact with outdoors than adults.



Child participants were between the ages of 10–12. To participate, the child had to live and attend school within the program boundaries for at least one year. Permission from the child's parent was also required.

How many children participated?

- ◆ 53 children participated. The children were split into two groups.
 - ◆ 36 children from urban and rural areas within the program area
 - ◆ 17 children from Paul First Nation

What did the child participants do?

- ◆ Give a sample of blood, urine and hair. These samples were analyzed the same way as those submitted by the adults.
- ◆ Personal air monitors were not worn by the children. Wearing these monitors may be difficult for these participants. In addition, this type of monitoring is also known to be unreliable with children.



Children's Results

Nicotine

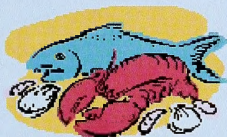
- ◆ No nicotine was detected in blood samples.

Mercury

- ◆ For children and adults, common sources of mercury are dental fillings and eating fish.
- ◆ Levels of mercury in the children's blood, hair and urine samples were low. These values were also lower than children living in other areas.

Arsenic

- ◆ Common sources of arsenic are water from wells, seafood or mushrooms.
- ◆ Arsenic levels in urine were low and similar to those reported in children living in other places.



Immunoglobulin gamma (IgE)

- ◆ The children had higher IgE levels than the adult participants.
- ◆ However, this is common in children, as IgE levels are high when we are young and then decline with age.

Autoantibodies

- ◆ 25% (13/52) of children had positive autoantibody results.
- ◆ A comparative population was not available in the scientific literature. Therefore, a clear understanding of these results is not possible without further investigation and samples.



Multiple Sclerosis in Wabamun and Surrounding Area

Multiple sclerosis (MS) is a disease which affects the brain and nerves. MS is unpredictable and individuals can have a variety of symptoms.

Community members from Wabamun and surrounding area had concerns about the perceived high number of MS cases in their communities. To see if there is an increased rate of MS in this area, a health record analysis was completed.



In the health record analysis, the rate of MS in Wabamun and surrounding area was compared to Alberta's provincial average.

How was this done?

- ◆ The observed, or number of people with MS were identified from records of doctor visits from 1995 to 2004.
- ◆ An expected number based on the provincial rate was calculated for that time period and by age and gender.

What was found?

- ◆ For Wabamun and surrounding area, the number of observed cases of MS was within the range of what is expected.
- ◆ The number of cases found were not different than provincial rates in any age group.

Glossary of Terms

Background sources:

These are naturally occurring sources of air contaminants. They are what we would expect to find if there was no local or regional development in the area.

Chronic Obstructive Pulmonary Disease (COPD):

Long term lung disease usually caused by smoking. Symptoms include shortness of breath, increased mucus and coughing. COPD includes people who have chronic bronchitis and emphysema.

Local sources:

Sources of air contaminants close or nearby to the residents. Examples includes: outdoor fireplaces, wood burning furnaces, vehicle exhaust, farming activities

Median:

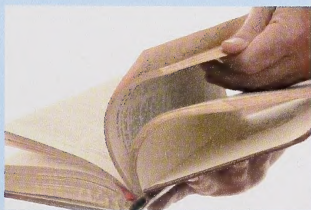
Midpoint reading of all measurements collected for each of the air monitors.

Regional sources:

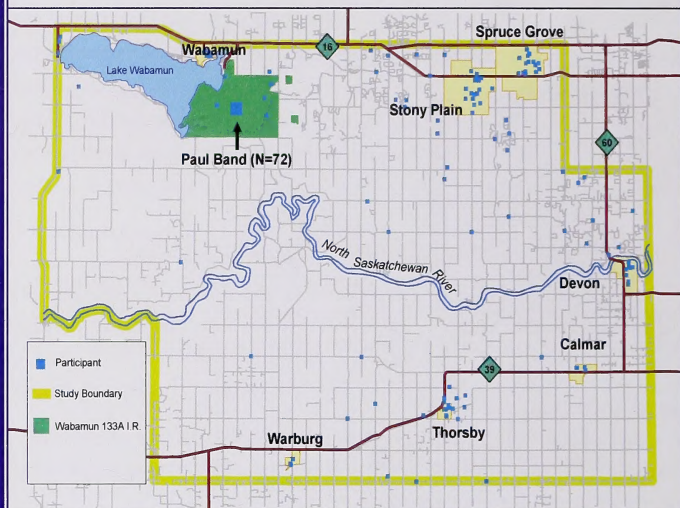
These are industry sources of air contaminants or effects from other communities in the area.

Spirometry:

A medical test used to measure the amount of air entering and exiting the lungs.



Wabamun and Area Community Exposure and Health Effects Program — Program Boundaries —



Note: Residences of participants have been slightly randomized to protect their confidentiality.

If you would like a full copy of the report, please contact
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